

Thermo-Electric and Voltaic Effects

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render them only a feeble voltaic combination with each other: and with respect to silver, which stands between tin and zinc thermo-electrically, not only must the same departure be required, but how great must the effect of this, its incongruous contact, be, to overcome so completely as it does, and even powerfully reverse the differences which the metals (according to the contact theory) tend to produce!

1049. In further contrast with such an assumption, it must be remembered that, though the series of thermo-electric bodies is different from the usual voltaic order (1000), it is perfectly consistent with itself, *i.e.* that if iron and antimony be weak with each other, and bismuth be strong with iron, it will also be strong with antimony. Also that if the electric current pass from bismuth to rhodium at the hot junction, and also from rhodium to antimony at the hot junction, it will pass far more powerfully from bismuth to antimony at the heated junction. To be at all consistent with this simple and true relation, sulphuric acid should not be strongly energetic with iron or tin and weakly so with silver, as it is in the voltaic circuit, since these metals are not far apart in the thermo series: nor should it be nearly alike to platinum and gold voltaically, since they are far apart in the thermo series.

1050. Finally, in the thermo circuit there is that relation to heat which shows that for every portion of electric force evolved there is a corresponding change in another force, or form of force, namely heat, able to account for it; this, the united experiments of Seebeck and Peltier have shown. But contact force is a force which has to produce something from nothing, a result of the contact theory which can be better stated a little further on (1057, 1059, 1061).

1051. What evidence then for mere contact excitement, derivable from the facts of thermo-electricity, remains, since the power must thus be referred to the acid or other electrolyte used (1048) and made, not only to vary uncertainly for each metal, but to vary also in direct conformity with the variation of chemical action (862, 944, 980, 994, 1002)?

1052. The contact theorist seems to consider that the advocate of the chemical theory is called upon to account for the

phenomena of thermo-electricity. I cannot
perceive that See-
beck's circle has any relation to the voltaic pile,
and think that
the researches of Becquerel¹ are quite sufficient
to authorise,
that conclusion.

¹ *Annales de Chimie*, 1829, xli. 355; xlv. 275.